KING COUNTY CONVEYANCE SYSTEM IMPROVEMENT PROJECT

ALTERNATIVE USES OF THE KENMORE PARALLEL LAKELINE

JULY 1999

KING COUNTY
Department of Natural Resources

INTRODUCTION

It has been proposed that the existing Kenmore Lakeline be paralleled even if a North Treatment Plant is built to treat wastewater flows from the King County northern service area (includes parts of Snohomish County). Under current planning scenarios and with the construction of the North Treatment Plant by approximately 2010, a Kenmore parallel Lakeline would not otherwise be needed to convey northern service area flows to West Point. However, if a North Treatment Plant is delayed beyond 2010, additional conveyance facilities will need to be constructed to either store peak flows or convey higher flows to either the West Treatment Plant or East Treatment Plant.

The purpose of this memorandum is to:

- Describe the existing Lakeline location and purpose, including the current service area;
- Discuss alternative parallel Lakeline alignments including a pile-supported pipe in the lake, a parallel microtunnel, a conventional 108-inch to 144-inch diameter conventional tunnel or open trench construction along the Burke Gilman Trail right-of-way;
- Briefly compare alternative uses of a Lakeline parallel to convey and store wastewater now and later use it to either convey treated effluent from a North Treatment Plant to Puget Sound via Matthews Park, or to convey wastewater from the Matthews Park Pump Station north to the Kenmore Pump Station; and
- Present the range of planning level budgetary costs for each parallel Lakeline alternative use.

EXISTING LAKELINE

The existing 48-inch diameter pile-supported, underwater, Kenmore Lakeline conveys flow for approximately five miles along the northwestern shoreline of Lake Washington from the Kenmore Logboom Park Regulator to Matthews Park. The purpose of the Lakeline is to convey King County northern service area flows by gravity from the Logboom Park Regulator to the Matthews Park Pump Station. These flows are then pumped by the Matthews Park Pump Station and conveyed another ten miles through the Lake City Tunnel and the North Interceptor to the West Treatment Plant. The alignment of the Kenmore Lakeline from Kenmore to Matthews Park is shown on Figure 1.

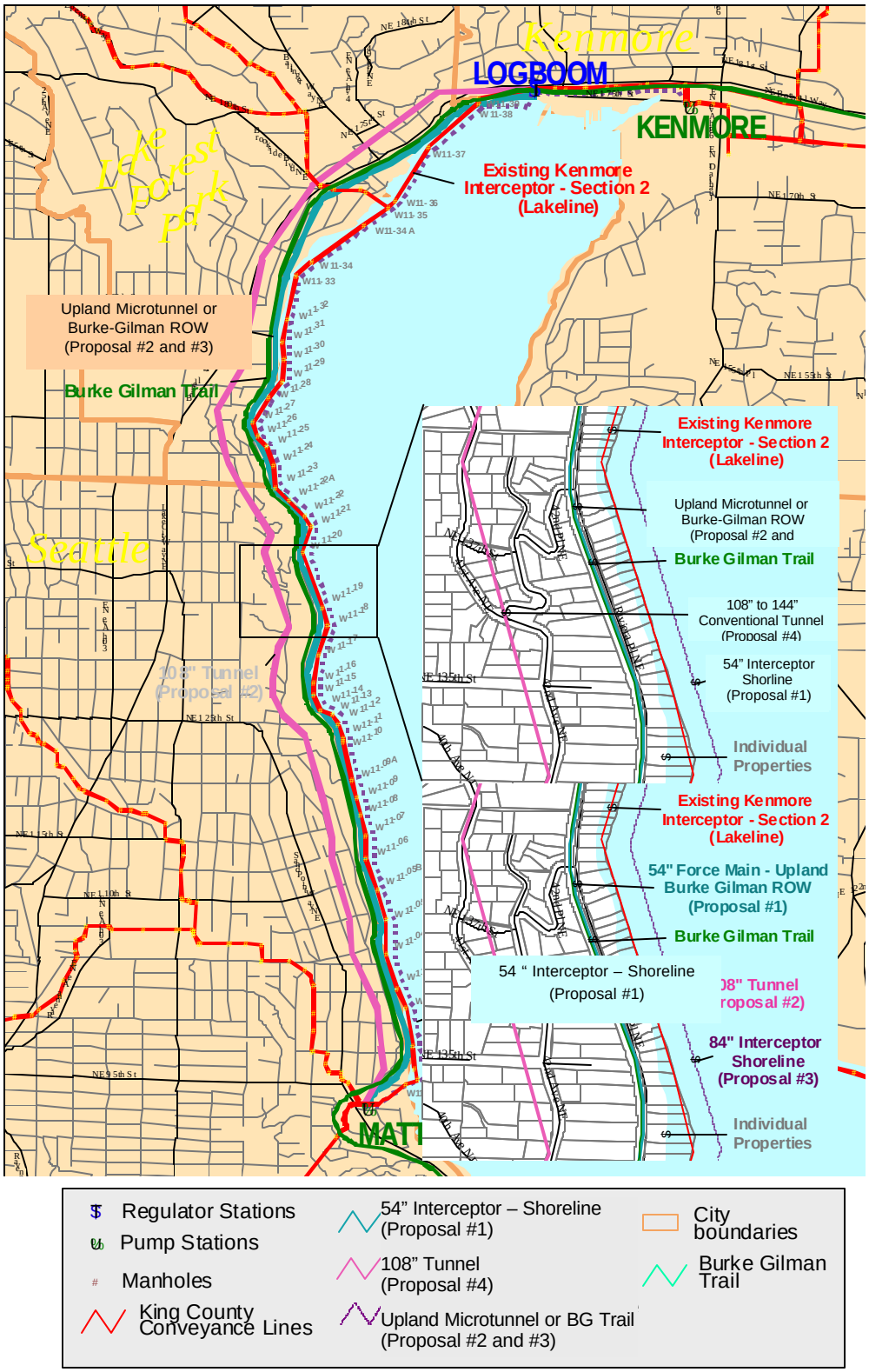


Figure 1. Kenmore Parallel Lakeline Representative Alternative Alignments

REDUCING LAKELINE SERVICE AREA AND FLOWS

The flow from several northern service area basins are collected and conveyed through the Kenmore Lakeline and on to the West Treatment Plant. The County significantly reduced the area served by the Kenmore Lakeline when the York Pump Station began operation in 1992. To further reduce flows to the Lakeline, the County has planned and constructed projects to store peak north service area peak flows. The County has also diverted flow from some of the north service area basins to the Eastside Interceptor (ESI), a pipeline aligned along I-405, east of Lake Washington. The ESI then conveys this flow to the East Treatment Plant in Renton for treatment.

Further Lakeline service area reductions will result from the commissioning of the new North Creek Pump Station, which is currently under construction, in the fall of 1999. The North Creek Pump Station will convey additional wet-weather flows from the north service area to the East Treatment Plant in Renton. Through 2003, summer wastewater flows from the north service area will continue to be routed to the West Treatment Plant to take advantage of capacity in the system during low dry-weather system flows.

In addition to diverting basins (transferring flows) away from the Lakeline, the County has planned and constructed storage projects to reduce peak flows through the Lakeline. Peak flows are experienced just after the most intense rainfall periods during storm events. Lakeline flows are reduced by storing peak period flows for later conveyance through the pipe after peak flows have decreased. These storage and diversion projects are described in Table 1.

Table 1
Facilities To Reduce Peak Flows To The Kenmore Pump Station

Project	Year In-service	Purpose
Logboom Storage	1988	Reduce peak flows to Kenmore Lakeline
York Pump Station	1992	Divert Redmond, Northeast Lake Sammamish basins to ESI
North Creek Pump Station	1999	Divert Woodinville, Bear Creek, and North Creek basins (in Snohomish and King Co.) to ESI
North Creek Storage	2005	Reduce peak flows to Kenmore Lakeline

Figure 2 shows the area originally served by the Kenmore Lakeline, the areas that have been diverted away from the existing Lakeline since 1992, and areas that are planned to be diverted in 1999.

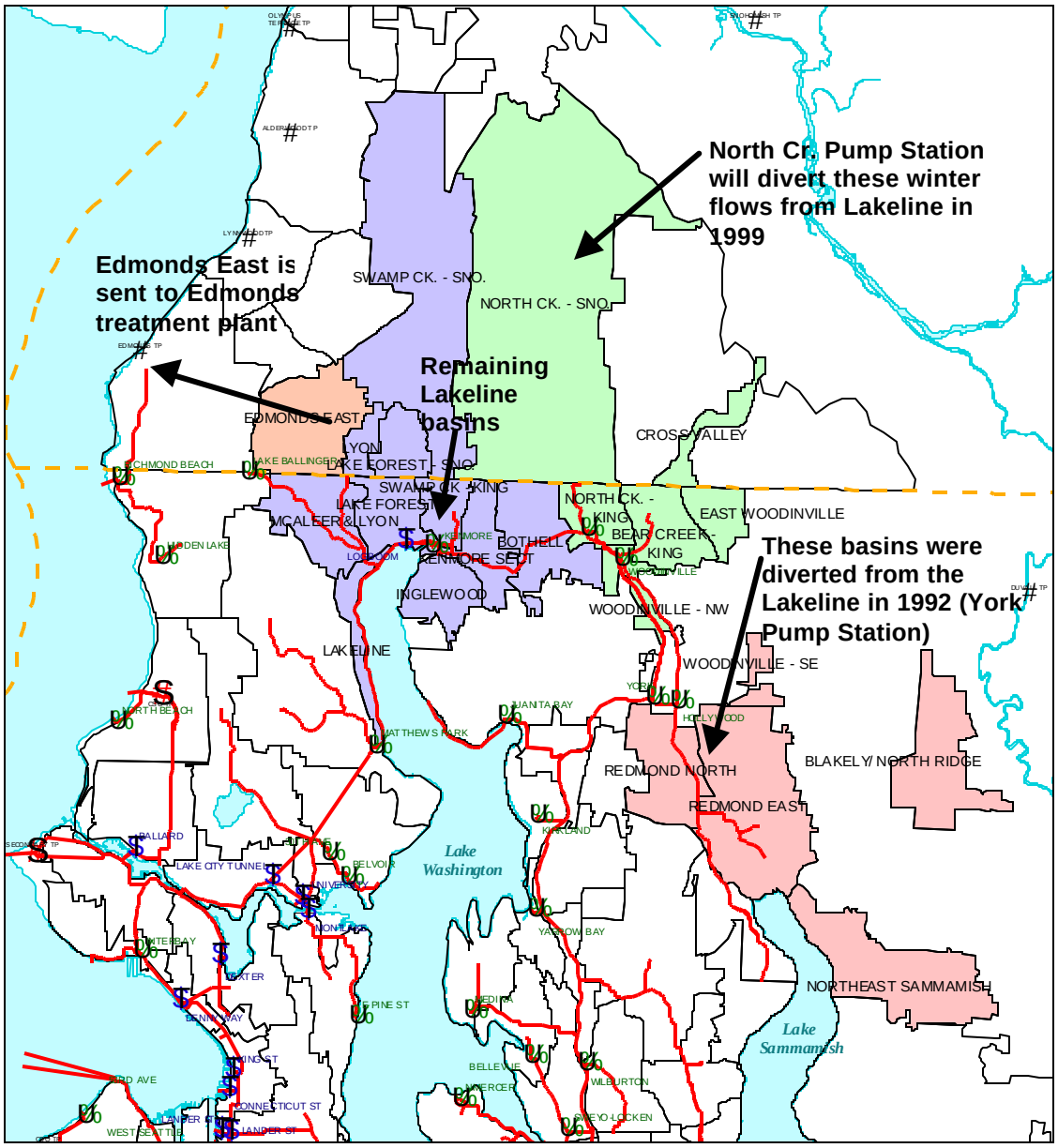


Figure 2. Remaining Lakeline Service Area

The relationship between needed storage and the predicted 20-year peak flow event is depicted in Figure 3. The required storage for a given peak flow event is represented by the area under the hydrograph but above the Lakeline capacity. For example, 9 MG of storage is required in 2010. This storage would be provided by 4 MG of storage in the Logboom Regulator, 2 MG of storage in the Bothell-Woodinville Interceptor, and 4 MG of storage in the North Creek Service Area for a total of 10 MG of storage. The 2 MG of storage in the Bothell-Woodinville Interceptor will become available in the fall of 1999 when flows are diverted by the North Creek Pump Station to the East Treatment Plant during the winter.

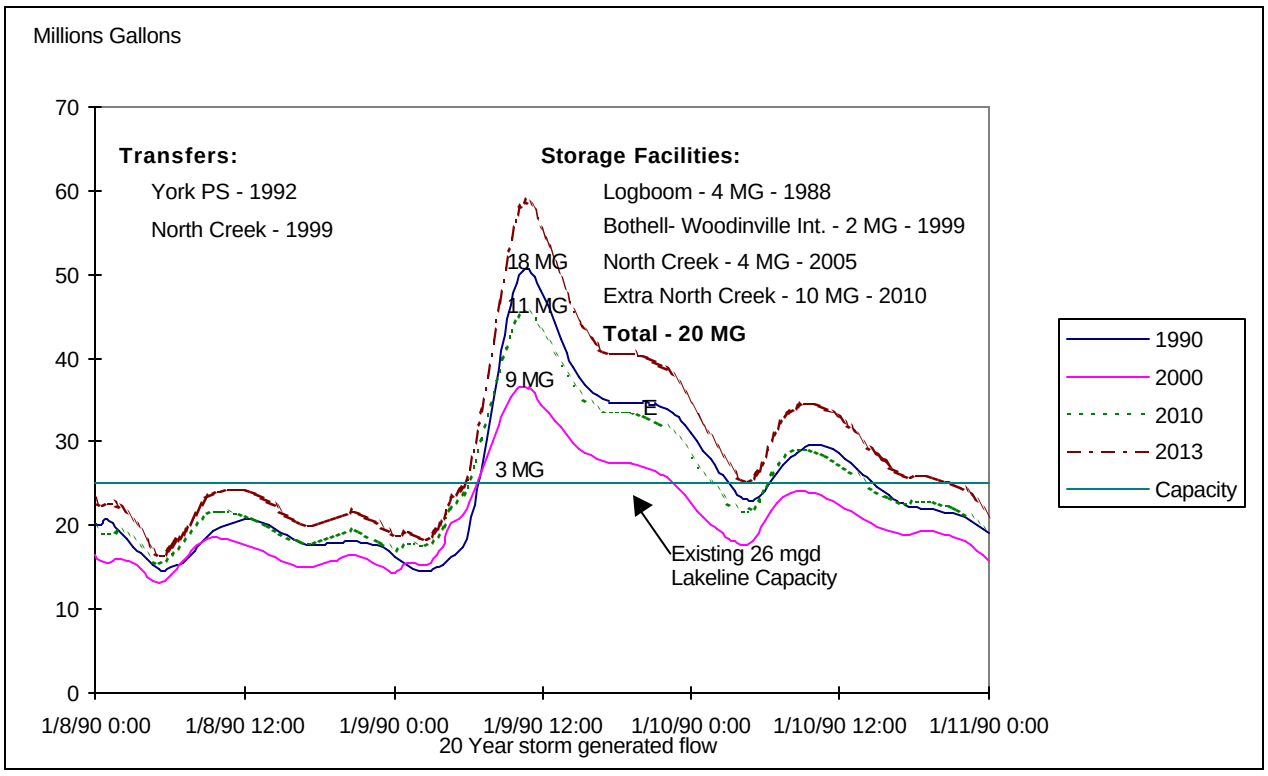


Figure 3. Predicted Kenmore Lakeline 20-year Peak Hydrographs for the Executive's Preferred Plan

The correlation between peak flow and storage is summarized in Table 2.

Table 2
Construction of North End Storage Facilities

Year	Storage Facilities	Storage Available (MG)	Storage Required (MG)
2000	Logboom, Bothell-Woodinville Interceptor	6	3
2010	Logboom, Bothell-Woodinville Interceptor, and North Creek(1)	10	9
2015	Logboom, Bothell-Woodinville Interceptor, North Creek, and Extra North Creek(2)	20	20

Notes:
(1) North Creek storage constructed in 2005.
(2) Extra North Creek Storage constructed in 2010.

Implementation of these diversion and storage facilities will mean that the existing Lakeline will have adequate capacity until at least 2010 when the North Treatment Plant is scheduled to be in operation. Figure 4 shows the portions of the north end peak flows that could be conveyed through the Lakeline which has a capacity of 26 mgd, diverted, and stored at the Logboom Park Storage Facility and other north-end storage facilities. This strategy could be used to manage flows until 2015 in case of a delay in constructing the Executive's proposed North Treatment Plant beyond 2010. These projections include the diversion of

up to 6 mgd of peak flow to the Edmonds Wastewater Treatment Plant starting in 2010 should the North Treatment Plant be delayed until 2015. Once these diversions, storage facilities, and North Treatment Plant are completed, the existing Kenmore Lakeline will serve only the near shore Lake Washington Basin and some of the McAleer/Lyon and Lake Ballinger Basins. After that time, the remaining flow in the Lakeline will be below the capacity of the existing Lakeline.

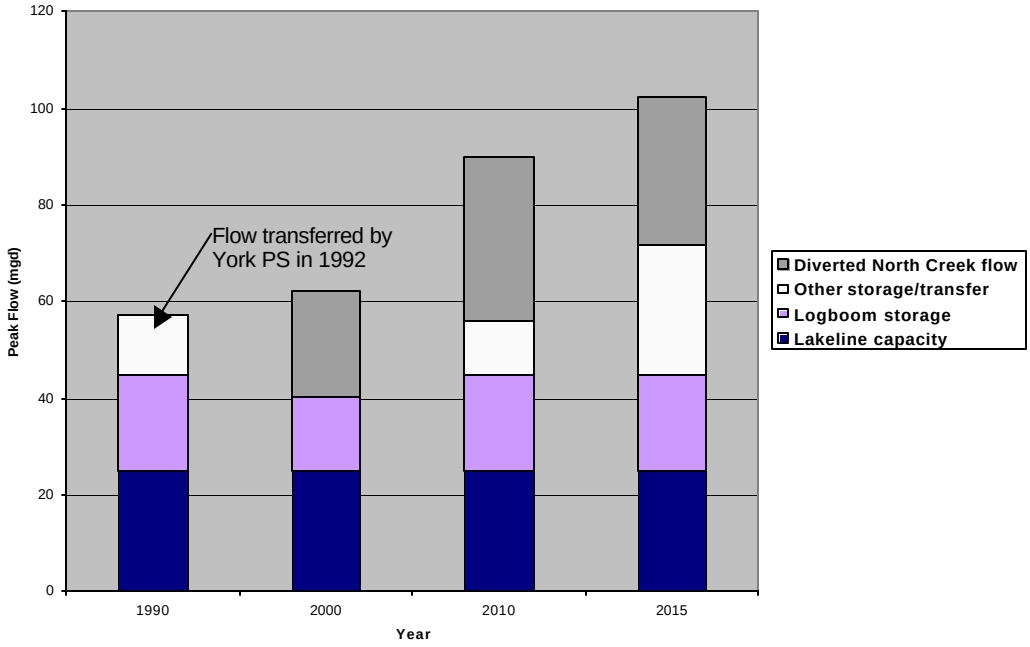


Figure 4. Interim North End Flow Management: 20-Year Peak Flows

The capacity of the existing 48-inch Kenmore Lakeline is 26 million-gallons-per-day (mgd). The proposed parallel Lakeline alternative includes completing construction of the Lakeline parallel by 2007. If this timeline is met, the construction of 4 MG of storage in the North Creek area projected for 2005 could be reduced to 2 MG to store and manage the 20-year peak storm flow.

ALTERNATIVE PARALLEL LAKELINE ALIGNMENTS

Four alternatives for paralleling the existing Kenmore Lakeline were evaluated in previous studies and revised to reflect current flow projections for the Lakeline:

1. A 54-inch dredged and pile-supported in-lake pipeline paralleling the existing Kenmore Lakeline in Lake Washington;

2. A series of 54-inch diameter microtunnels within the Burke Gilman Trail right-of-way;

3. Open trench construction of a pipeline within the Burke Gilman Trail right-of-way; and

4. A conventional (108- to 144-inch diameter) tunnel between Kenmore and Matthews Park.

Alternative 1 – Pile-Supported Gravity Lakeline

The Kenmore parallel Lakeline was thoroughly investigated in 1986 in the *Kenmore Interceptor Land Sections and Structures Predesign Report*. This report was referenced and updated in the 1995 *North Creek Diversion – Final Report*. Then, as part of the Wastewater 2020 Plus project, the County evaluated the feasibility and cost of a pile-supported parallel Lakeline. Based on revised flow projections in the Executive's Preferred Plan, the existing 48-inch diameter and a new 54-inch diameter, 27,000-foot long parallel pile-supported Lakeline would be sufficient to convey the projected peak flows.

Impacts of constructing a pile-supported parallel Lakeline include a number of environmental, permitting, and fisheries issues. These impacts are discussed in more detail in the 1995 *North Creek Diversion Final Report* and are summarized below.

- Sediments - Construction in the north end of Lake Washington would require dredging approximately 130,000 cubic yards of sediments, roughly 23,000 cubic yards of which is contaminated with DDT at concentrations of 10 to 1,458 parts per billion. Dredging DDT contaminated sediments during construction poses the potential for release of DDT into Lake Washington with possible near- and long-term damage to the ecosystem. In addition, it would be difficult to cost–effectively dispose of these contaminated sediments since the concentration of DDT in the dredgings would be such that disposal in Elliot Bay or elsewhere in Puget Sound would be prohibited.

- Fisheries – To minimize the impact on resident fisheries and migratory salmonids, construction would be restricted. In sockeye spawning areas, construction is only allowed from June 16 through October 31. In addition, negotiations with the Muckleshoot Indian Tribe would be required prior to construction of a parallel Lakeline to ensure an unobstructed treaty fishery.

- Endangered Species Act – A comprehensive biological assessment would be required to determine if any threatened or endangered species are likely to be affected by the construction of a pile-supported parallel Lakeline. If the biological assessment determines that any species is likely to be affected, the project may be further delayed, require additional mitigation, or not allowed to proceed.

- Easements – Easements within Lake Washington would be required from approximately 120-160 individual land owners and the Washington Department of Natural Resources depending upon the alignment of the parallel Lakeline.

The cost of this alternative would be $72 million. In addition, pump station improvements would be required at the Matthews Park at a cost of $8 million. If the North Treatment Plant is not in operation by 2010, the construction of the $54 million University CSO project would have to be accelerated.

Alternative 2 – Parallel Microtunnel

The Burke–Gilman trail extends approximately 27,000 feet from the Logboom Park Regulator Station to the Matthews Park Pump Station. Since the County does not own the Burke-Gilman Trail right-of-way, the County would be faced with significant right-of-way acquisition and permitting issues if a new Lakeline is constructed within the Burke Gilman Trail right-of-way. The area around the Burke-Gilman trail is highly developed with homes and streets located on both sides of the trail. There are also 14 street crossings of the trail in this reach.

As part of the 1986 Lakeline predesign effort and previous studies, 65 soil borings were taken in Lake Washington. The soils encountered with these borings were Vashon Till, a very dense soil that contains cobbles and boulders; clay with a strong possibility of boulders; and young alluvial deposits consisting of primarily sand and gravel. The remainder of the alignment is expected to consist of fill, peat and sand. Soils containing cobbles and boulders would be problematic for microtunnelling construction methods.

Microtunneling techniques are restricted to relatively straight alignments and short lengths between jacking and receiving pits. Therefore to make turns and over this length, the microtunnel alternative would require approximately 25 jacking and receiving pits along the Burke-Gilman Trail. These jacking and receiving pits would be disruptive (closures and detours) to users of the trail and would have to be located to maintain access to residences. Excavated material would have to be removed and hauled away from these locations. In addition, the tunneling activities will create short-term noise and vibrations that would likely be heard and felt by residences along the trail.

The cost of this alternative is $62 million. Improvements similar to Alternative 1 would be required at Matthews Park and the University CSO project would again have to be accelerated if the North Treatment Plant were not in operation by 2010.

Alternative 3 – Open-Trench in Burke-Gilman Trail

The King County *Wastewater 2020 Plus Conveyance and Treatment Alternatives Screening and Refinement Final Report* prepared in 1996 reviewed open trench alternatives for the Kenmore Lakeline along the Burke-Gilman Trail previously evaluated in the *Puget Sound Facilities Engineering Report* prepared in 1986. Alternatives that were updated for the revised peak flow projection are summarized below.

This alternative would consist of 24,700 feet of 42-inch diameter forcemain from the Kenmore Pump Station to approximately 4,300 feet upstream of the Matthews Park Pump

Station where the line would transition to a 54-inch gravity sewer. Anticipated problems associated with this alternative include:

- Relocation of existing utilities;
- Adverse wet soil conditions;
- Impacts to recreational and other users of the Burke-Gilman Trail;
- Generation of sulfides in the long forcemain requiring additional odor control facilities at the forcemain discharge;
- Difficulty of maintaining access to adjacent dwellings; and
- Provision of alternative routing around construction for trail users.

Including Kenmore Pump Station improvements, this alternative would cost $61 million. As with Alternatives 1 and 2, Matthews Park upgrades would be required and if the North Treatment Plant were not on-line by 2010 the University CSO project would need to be accelerated.

Alternative 4 – Parallel Conventional Tunnel

This alternative is currently being proposed by the King County Council Committee-of-the Whole. The 108- to 144-inch diameter conventional tunnel would provide 12.8 MG to 22.8 MG of additional storage upstream of the existing Matthews Park Pump Station by 2007. At a minimum, this volume of storage plus 2 MG built by 2005 is approximately equal to the alternative of 14 MG of storage proposed upstream of the Kenmore Pump Station in lieu of a parallel Lakeline. Even with the Lakeline parallel tunnel, the construction of 2 MG of storage upstream of the Kenmore Lakeline would be required by 2005 to help store the 20-year peak flows until the parallel Lakeline is put in service in 2007. If the parallel Lakeline tunnel is delayed beyond 2007, an additional 2 MG (total of 4 MG) of storage would be required.

A conventional tunnel would not have some of the limitations of a microtunnel. For example, the number of access shafts would be reduced from the number required for a microtunnel and the tunnel could be constructed on a curved alignment. However, both conventional tunnel and microtunnel construction would have some of the same issues:

- Soils – Some of the soils in the area will likely contain boulders – increasing the risk of any trenchless construction technique. A detailed geotechnical exploration program and analysis of the proposed route would be required to evaluate tunneling techniques.

- Soil Removal – For a 108-inch diameter tunnel, over 100,000 cubic yards of soil would need to be hauled away, which would require several thousand truck trips. For a 144-inch tunnel, over 160,000 cubic yards of soil would be removed. The daily number of truck trips would depend upon the boring speed.

Figure 5 illustrates conventional tunnel potential portals/access shaft locations and alignment area.

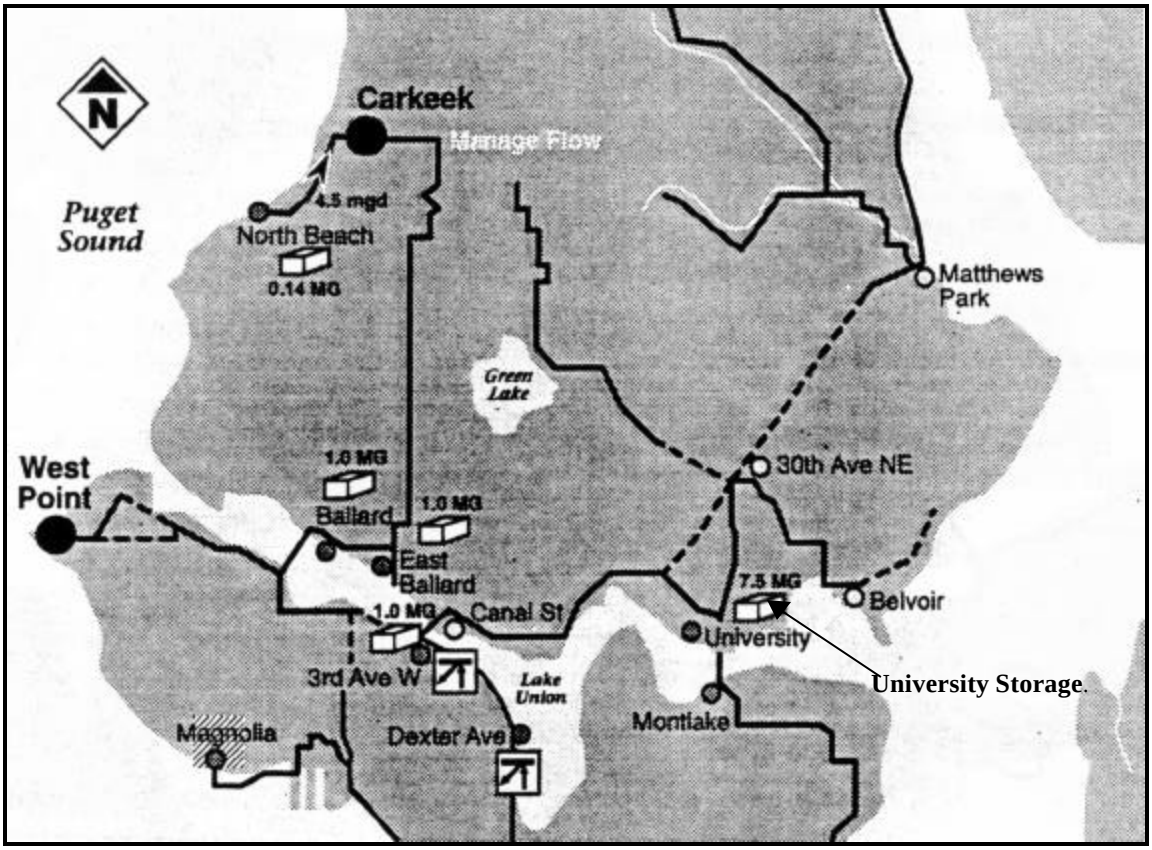
Figure 5. Possible Conventional Tunnel Alignment Area and Portal Locations

This conventional tunnel alternative would cost approximately between $119 and $162 million for diameters between 108- and 144-inches. In comparison, it would cost approximately $21 million (1998 Dollars) to provide 4 MG of storage in the North Creek Area and an additional $47 million for 10 MG of storage in the North Creek area, for a total

cost of $68 million for 14 MG of North End Storage. In addition, a new pump station at the south end of the tunnel at Matthews Park would cost approximately $8 million. University CSO costs would be reduced by approximately $9 million. North Creek storage would be decreased from 4 MG to 2 MG if the parallel Lake-line can be put in service by 2007. This would result in a cost savings of $11 million.

Conveyance Downstream of the Matthews Park Pump Station

According to the CSO analysis conducted for the Wastewater 2020 Plus project and cited in the *North Creek Diversion, Final Report*, a parallel Kenmore Lakeline would have detrimental impacts on CSOs associated with the North Interceptor. If the North Treatment Plant were not on-line by 2010, the required CSO improvements in the University area (Figure 6) would have to accelerated by five years to 2010 to address these impacts. No additional CSO facilities or accelerated construction would be required as long as the North Treatment Plant is on-line by 2010. If a 108-inch parallel tunnel is constructed, the University CSO project could be reduced in size by 2 MG, saving approximately $9 million in total capital costs that were projected to be $54 million.



Note: Accelerated construction of University Storage is not required if a 108-inch diameter tunnel is constructed.

Figure 6. CSO Facilities Affected by a Parallel Lakeline

ALTERNATIVES USES FOR A PARALLEL LAKELINE

The initial purpose of a parallel Kenmore Lakeline would be to convey raw wastewater from the north service area basins to the West Treatment Plant until the North Treatment Plant is built. After the North Treatment Plant is built, the capacity of the existing Lakeline would be adequate to convey the remaining wastewater flow from Kenmore to the West Treatment Plant. At this point, the parallel Lakeline would no longer be needed to convey raw wastewater the West Treatment Plant. Therefore, alternative uses for the parallel Lakeline, once flows are diverted to the North Treatment Plant, were evaluated. These alternatives are as follows:

- Store peak storm flows in the parallel Lakeline to reduce peak flows to the Matthews Park Pump Station and downstream facilities.

- Convey treated effluent from the North Treatment Plant to the Matthews Park Pump Station. Additional piping or a tunnel would then be required to convey this flow from Matthews Park Pump Station to a Puget Sound outfall. One of the shortest alignments (used as an example) would be another tunnel from Matthews Park to Carkeek.

- Convey wastewater from Matthews Park Pump Station to Kenmore to be transferred to and treated at a new North Treatment Plant.

Use Parallel for Future Storage of Peak Flows

Once a North Treatment Plant is on-line, the Kenmore parallel Lakeline would not be needed for storage of peak flows. The volume of parallel Lakeline storage that would be available would vary depending upon the construction alternative. With the exception of the upland forcemain (only 0.4 MG), the volume of storage in the parallel Lakeline would vary from 3.2 to 22.8 MG (Table 3). This storage would supplement the 4 MG of existing storage in the Logboom Park Regulator and could be operated to reduce peak flows to the Matthews Park Pump Station and University Regulator. The flows would then be conveyed to the West Treatment Plant. The only significant benefit of this alternative use of the parallel Lakeline would be to reduce the size of CSO storage upstream of the University Regulator by 2 MG. However, treatment would still be required at the West Treatment Plant unless the stored wastewater is pumped back from Matthews Park to the North Treatment Plant for treatment.

Table 3
Parallel Lakeline Storage

Alternative Alignment	Volume (MG)
1. Pile supported parallel Lakeline (54-inch)	3.2
2. Microtunnel within the Burke Gilman Trail right-of-way (54-inch)	3.2
3. Forcemain along the Burke Gilman Trail right-of-way (gravity section only)	0.4
4. Conventional tunnel parallel to the Burke Gilman Trail right-of-way (108-inch)	12.8
Conventional tunnel parallel to the Burke Gilman Trail right-of-way (144-inch)	22.8

Use Parallel to Convey North Treatment Plant Effluent

A completely separate system would be required to convey treated effluent from the North Treatment Plant to Puget Sound. If the North Treatment Plant is located adjacent to Puget Sound, the most practical alternative is to construct a new outfall in the vicinity of the North Treatment Plant. However, if the North Treatment Plant is constructed in the vicinity of the Kenmore Pump Station, it may be feasible to use the parallel Lakeline as part of an effluent transfer system.

This effluent transfer system would need to be designed to convey the projected peak flow. At saturation, the projected peak hour flow for the North Treatment Plant under the Executive's Preferred Plan is 160 mgd, while the capacity of all of the proposed parallel Lakeline alternatives discussed earlier, except a parallel 108-inch tunnel, is 31 mgd. A 54-inch Lakeline would not be sufficient to even convey the initial effluent flow. In 2015, the projected peak flow to the North Treatment Plant is 50 mgd and in 2020, the projected peak flow to the North Treatment Plant is 65 mgd. Therefore, there would be no benefit of constructing a parallel 54-inch Lakeline to convey wastewater in 2010 and effluent later. Of the parallel Lakeline alternatives evaluated, only a 108-inch tunnel would have sufficient capacity to convey the effluent to Matthews Park. Another tunnel would then be required to convey the flow to Puget Sound.

The components of the initial effluent transfer system would include:

- A new 70 mgd pump station adjacent to the Kenmore Pump Station, expandable to 160 mgd peak capacity;
- A 96-inch parallel tunnel (if a 108-inch parallel tunnel is not constructed initially);
- A new 70 mgd effluent transfer pump station adjacent to the Matthews Park Pump Station, expandable to 160 mgd peak capacity;
- A 96-inch tunnel from the Matthews Park Pump Station to a new outfall on Puget Sound (either 9.6 miles to West Point or 4.5 miles to Carkeek);
- A new outfall in Puget Sound.

Two locations were considered for a new outfall in Puget Sound, near West Point and near Carkeek Park. The existing 96-inch diameter outfall for the West Treatment Plant has a capacity of 440 mgd at high tide when all three effluent pumps are operating. For six days in 1998, the peak flow at the West Treatment Plant exceeded 430 mgd, so there is no excess capacity in the West Treatment Plant outfall. Based on a peak velocity of 16 fps, the existing 33-inch diameter outfall at Carkeek would be able to convey only 58 mgd, significantly less than the 160 mgd projected peak flow from the North Treatment Plant. Therefore, neither the existing outfall at Carkeek nor the existing outfall at West Point has the capacity to convey effluent from the North Treatment Plant and a new outfall would need to be constructed.

West Point is approximately 9.6 miles from the Matthews Park Pump Station and Carkeek is approximately 4.5 miles away (Figure 7). Given the shorter distance from the Matthews Park Pump Station to Carkeek, it appears to be the more likely alternative and is used to develop the estimated total project cost for this alternative use. The total project cost of $245 million is in addition to the $119 million to construct a 108-inch diameter parallel Lakeline resulting in a cumulative minimum total project cost of $364 million.

By comparison, the estimated total project cost to convey treated effluent from the new North Treatment Plant through a 96-inch diameter tunnel from the Kenmore area directly to a new outfall at Point Wells is $165 million.

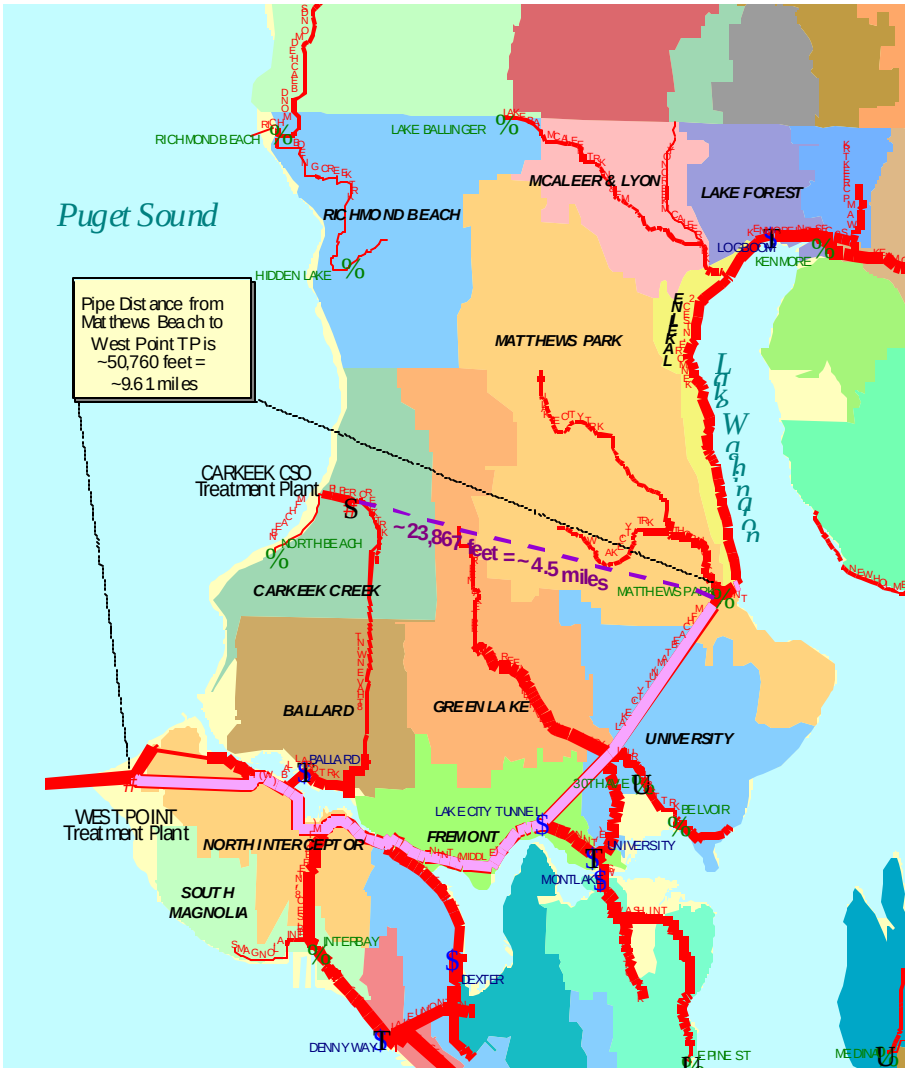


Figure 7. Distances From Matthews Park to Puget Sound

Use the Parallel to Convey Wastewater from Matthews Park to Kenmore

Once north end basin flows are diverted from the existing Kenmore Lakeline to the North Treatment Plant, the Matthews Park Pump Station could be modified to pump wastewater from the Matthews Park basin to Kenmore. The projected 20-year peak flow from the Matthews Park basin at saturation is approximately 81 mgd.

Based on these flow projections, the following improvements would be required to pump wastewater north from the Matthews Park Pump Station to the vicinity of the Kenmore Pump Station:

- Modify the Matthews Park Pump Station to pump north;
- A 60-inch forcemain in the 108-inch tunnel from the Matthews Park Pump Station to Kenmore; and
- A pump station at Kenmore to pump flows to the North Treatment Plant.

An order of magnitude total project cost for these conveyance components is $140 million. Additional capital costs not a part of this $140 million include the cost to convey wastewater from Kenmore to the North Treatment Plant, expansion of the North Treatment Plant, and the cost to convey treated effluent from the North Treatment Plant to Puget Sound. Since a site has not been established for the North Treatment Plant, these additional conveyance costs could not be determined.

PROJECT CAPITAL COSTS

Project capital costs for the various conveyance alternatives were developed based on previous planning level estimates including those outlined in the RWSP Technical Memorandum *Population Forecasts, Flow and Loading Projections Methodology Comparison* prepared in 1998, the *Wastewater 2020 Plus Conveyance and Treatment Alternatives Screening and Refinement Final Report* prepared in 1996, and the *North Creek Diversion Final Report* prepared in 1995. Where previous costs were available they were translated into 1998 dollars by adjusting for inflation in construction costs as determined by the increase in the Engineering News Record Construction Cost Index (ENR CCI). The project costs presented below include planning level contingencies of 25 percent, 8.2 percent sales tax, and 35 percent for allied costs such as engineering, permitting, and management.

Cost Summary

There are a number of capital projects required for each alternative use of the Lakeline. As a common basis of comparison, the following assumptions were used to compare alternative uses of a parallel Lakeline and North Creek Storage if a parallel Lakeline is not constructed:

- A 108-inch parallel tunnel ($119 million) to 144-inch parallel tunnel ($162 million)
- Construction a new pump station near Matthews Park at the south end of the tunnel ($8 million);
- Construction of 2 MG of storage ($11 million) in 2005 in lieu of 4 MG of storage in 2005 ($21 million) assuming the parallel tunnel is completed by 2007; and
- A 2 MG smaller University CSO storage facility at a savings of $9 million.

A few of the alternative uses of the Lakeline would require additional conveyance facilities as noted in Table 4.

Table 4
108- to 144- Inch Tunnel Alternative Use Costs

	Cumulative Capital Cost in Millions of Dollars –1998		
Alternative Use	**Lakeline Cost**	**Additional Costs**	**Total Project Costs**
Future storage of peak flows upstream of Matthews Park and the University Regulator	$119 (108") to $162 (144")	$8	$127 - $170
Convey North Plant effluent to Matthews Park PS and on to Puget Sound		$245	$364 - $407
Convey Future Matthews Park PS flows to the Kenmore PS		$140	$259 - $302

If the parallel Lakeline tunnel can be put in service by 2007, a savings of $10 million could be realized by reducing the additional interim storage required from 4 MG to 2 MG.

ALTERNATIVE NORTH SERVICE AREA STORAGE LOCATIONS

Based upon previous analysis, the construction of storage upstream of the Kenmore Pump Station would be significantly less expensive and have fewer environmental and construction impacts than any of the parallel Lakeline alternatives. In the 1995 Technical Memorandum *Preliminary Evaluation of Storage Between Kenmore and North Creek*, several alternative sites were identified for upstream storage with a total combined storage volume of 32 MG. These sites, shown on Figure 8, are generally located in Park and Ride lots, a golf course, and a sod farm along the Kenmore, Swamp Creek and North Creek Interceptors in Kenmore and Bothell. As a result, the environmental and construction impacts of storage in these locations would be significantly more localized than the impacts of any parallel lake-line alternative.

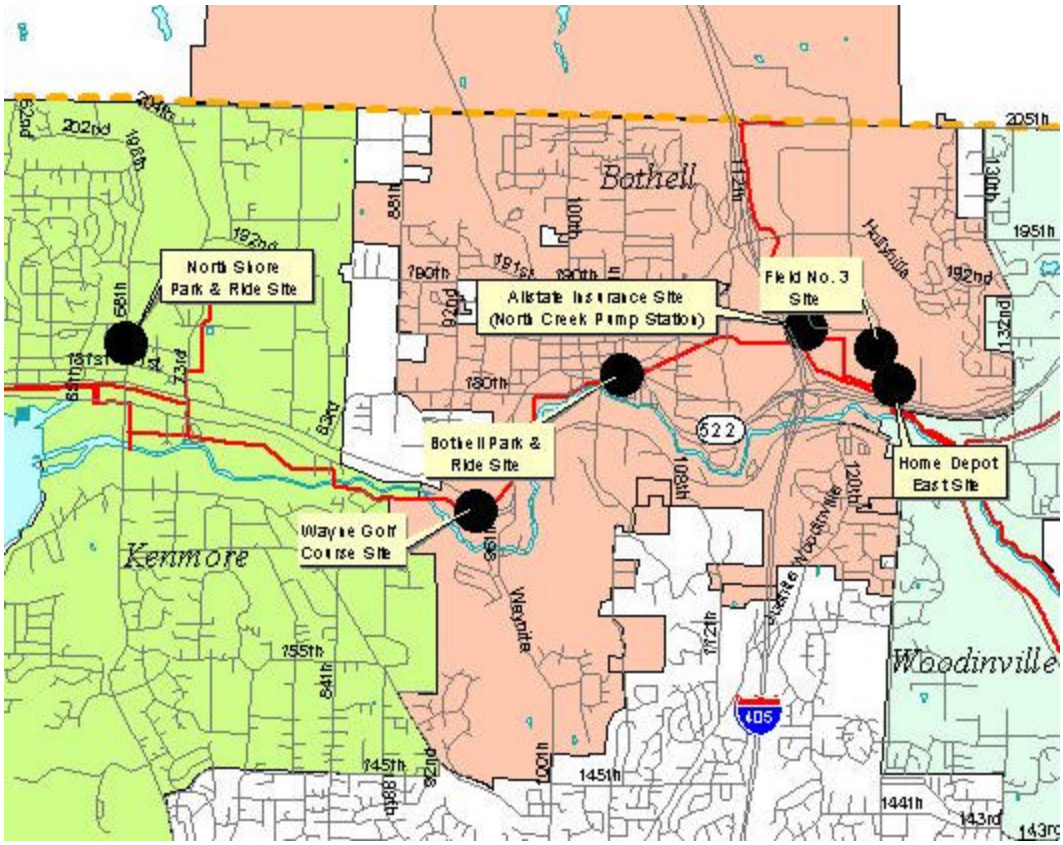


Figure 8. Alternative North Service Area Storage Sites

CONCLUSIONS

Three alternative uses for a parallel Lakeline were analyzed to determine planning level total project costs for these alternative uses as well as social and environmental impacts of each use assuming a North Treatment Plant is delayed beyond 2010.

Storage Comparison

The use of the 108-inch tunnel for storage would cost approximately $127 million versus $68 million for the construction of the requisite storage in the North Creek Area, an additional capital cost of $59 million.

In addition to being less expensive, construction of storage upstream of the Kenmore Pump Station could be constructed in phases and would have fewer environmental and construction impacts than the parallel Lakeline alternatives.

Convey Treated Effluent

Conveying treated effluent in the 108-inch tunnel to Matthews Park and then to Puget Sound would require the construction of additional conveyance facilities at an added cost of approximately $245 million. In comparison, the estimated total project cost to convey treated effluent from a North Treatment Plant in the North Service Area and build a new outfall is $165 million. Therefore, even with a 108-inch parallel tunnel in-place, it would be less expensive to convey treated effluent directly to Puget Sound than via a parallel Lakeline tunnel and an effluent pump station in Matthews Park.

Convey Wastewater from Matthews Park to Kenmore

Once north end basin flows are diverted from the existing Kenmore Lakeline to the North Treatment Plant, the Matthews Park Pump Station could be modified to pump wastewater from the Matthews Park Basin to Kenmore.

The additional project cost to provide the conveyance facilities to return this flow to Kenmore, as would be possible by locating storage upstream of the Kenmore Pump Station, would be an $140 million. Therefore, in order to make long term use of the parallel tunnel for storage upstream of the North Treatment Plant, the capital cost would be more than $186-$229 million more than the cost of storage upstream of the Kenmore Pump Station. Since the North Treatment Plant has not been sited, the capital cost for conveyance facilities from Kenmore to the North Treatment Plant were not estimated.